TETE BAYOU TMDL FOR FECAL COLIFORM

SUBSEGMENT 060701

US EPA Region 6

Final

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TABLE OF CONTENTS

List of Tables

List of Figures

EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to identify waterbodies that are not meeting water quality standards and to develop total maximum daily pollutant loads for those waterbodies. A total maximum daily load (TMDL) is the amount of a pollutant that a waterbody can assimilate without exceeding the established water quality standard for that pollutant. Through a TMDL, pollutant loads can be distributed or allocated to point sources and nonpoint sources discharging to the waterbody. A TMDL for the May – October season has been developed for fecal coliform bacteria for Tete Bayou. Fecal coliform bacteria are monitored as the indicator for potential human health threats resulting from swimming.

Tete Bayou subsegment 060701 was listed on both the 1998 and the October 28, 1999 Court Ordered §303(d) Lists as not fully supporting the water quality standard for primary contact recreation (swimming). Louisiana's water quality standard for protection of the primary contact recreation use reads as follows:

> "Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 200/100mL, nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 400/100mL. These primary contact recreation criteria shall apply only during the defined recreational period of May 1 through October 31. During the non-recreational period of November 1 through April 30, the criteria for secondary contact recreation shall apply."

The standard for secondary contact recreation reads similarly: "Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 1,000/100 mL, nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 2,000/100 mL."

Seven months of LDEQ monitoring data (1998) on Tete Bayou (collected at sampling site #0675) was assessed to determine if the primary and secondary contact recreation uses were being maintained. Analysis of the data for the November – April season shows that the secondary contact recreation use is being maintained (see Appendix A). Analysis of the data for the May – October season shows that the primary contact recreation use is not protected (see Appendix A). Therefore, a TMDL has been developed to protect the May – October season.

For the purpose of calculating current loading on Tete Bayou the average fecal coliform concentration for the May – October season was calculated using monthly LDEQ monitoring data from sampling site #0675 in Iberia Parish. In Tete Bayou, the monthly fecal coliform counts for this season ranged from 130 colony forming units (cfu)/100ml to 16,000 cfu/100ml.

For the purpose of TMDL development, the criterion of 200/100mL was applied. A fecal coliform loading curve for the recreational period (May 1 – October 31) has been generated as Figure 1. This loading curve was developed using Equation 1, substituting the criterion, 200 cfu/100 ml, for FC concentrations and varying flows. The attempt here is to show that while a TMDL may be expressed as a single point it can also be thought of as a continuum of points representing the criterion value and various flow values. A 92% reduction in fecal coliform loading during the May – October season will be needed to protect the primary contact recreation use.

1. Introduction

Tete Bayou subsegment 060701 was listed on both the 1998 and the October 28, 1999 Court Ordered §303(d) Lists as not fully supporting the water quality standard for primary contact recreation (swimming). On the 1998 List, this segment was ranked as a high priority (1) for TMDL development. A TMDL for fecal coliform bacteria was developed in accordance with the requirements of Section 303 of the federal Clean Water Act. The purpose of a TMDL is to determine the pollutant loading that a waterbody can assimilate without exceeding the water quality standard for that pollutant; the TMDL also establishes the load reduction that is necessary to meet the standard in a waterbody. The TMDL consists of the wasteload allocation (WLA), the load allocation (LA), and a margin of safety (MOS). The wasteload allocation is the load allocated to point sources of the pollutant of concern, and the load allocation is the load allocated to nonpoint sources. The margin of safety is a percentage of the TMDL that accounts for the uncertainty associated with the model assumptions and data inadequacies.

2. Study Area Description

2.1 General Information

Water quality subsegment 060701 is part of the Vermilion-Teche River Basin. The Basin encompasses the prairie region of the state and a section of the coastal zone. The Vermilion-Teche River Basin is bounded on the north by the Red River Basin, on the east by the Atchafalaya Basin, on the west by the Mermentau River Basin and southward by the Gulf of Mexico. The average annual rainfall in the vicinity of Tete Bayou is approximately 58 inches. Land use in the Vermilion-Teche Basin is largely agriculture, the primary crops being corn, soybeans, and milo. The Alexandria urban area is located to the north. Suburban communities have developed in the agricultural lands immediately south and west of Alexandria. The land use for the Vermilion-Teche River Basin is summarized in Table 1.

Table 1. Land Use (acres) in Segment 0607: Vermilion-Teche Basin

SEGMENT	AGRICULTURE	URBAN	WETLAND	FOREST
0607	29,956 (55.2%)	1799 (3.3%)	21,834 (40.3%)	640 (1.2%)

2.2 Water Quality Standards

The designated uses for Tete Bayou include both primary contact recreation and secondary contact recreation. Fecal coliform bacteria serve as the indicator used for the water quality criteria and for assessment of use support. Louisiana's water quality standard for protection of the primary contact recreation use reads as follows:

"Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 200/100mL, nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 400/100mL. These primary contact recreation criteria shall apply only during the defined recreational period of May 1 through October 31. During the non-recreational period of November 1 through April 30, the criteria for secondary contact recreation shall apply."

The standard for secondary contact recreation reads similarly: "Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 1,000/100 mL, nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 2,000/100 mL."

2.3 Identification of Sources

The sources identified in the *1998 Louisiana Water Quality Inventory* as affecting the water quality of Tete Bayou are unknown sources.

2.3.1 Point Sources

Searches were made of the EPA Permit Compliance System (PCS) database and the LDEQ permit database to identify facilities that discharge to this segment. Using this procedure, EPA identified 1 facilities discharging sanitary wastewater into Tete Bayou. The flow from this discharge is 2,500,000 gallons per day (see Table 2).

Table 2. Dischargers in Subsegment 060701

Dischargers to Tete Bayou			
Facility	Permit #	Design Flow (gal/day)	Wasteload Allocation (cfu/day)*
City of New Iberia	LA0065251	2,500,000	1.89 E10
	Totals:	2,500,000	1.89 E10

*see section 3.3 for WLA calculation

2.3.2 Nonpoint Sources

The predominant land uses in the Tete Bayou watershed are agriculture, urban, and forestry. It is unknown to what extent each of these sources contributes to fecal coliform loads through runoff.

3. TMDL Load Calculations

3.1 Current Load Evaluation

Fecal coliform loads have been calculated using the instream bacterial counts and the flow of the stream. The following equation can be used to calculate fecal coliform loads.

Equation 1. C x 1000mL/ L x 1 L/0.264 gallons x Q in gallons/day = cfu/day

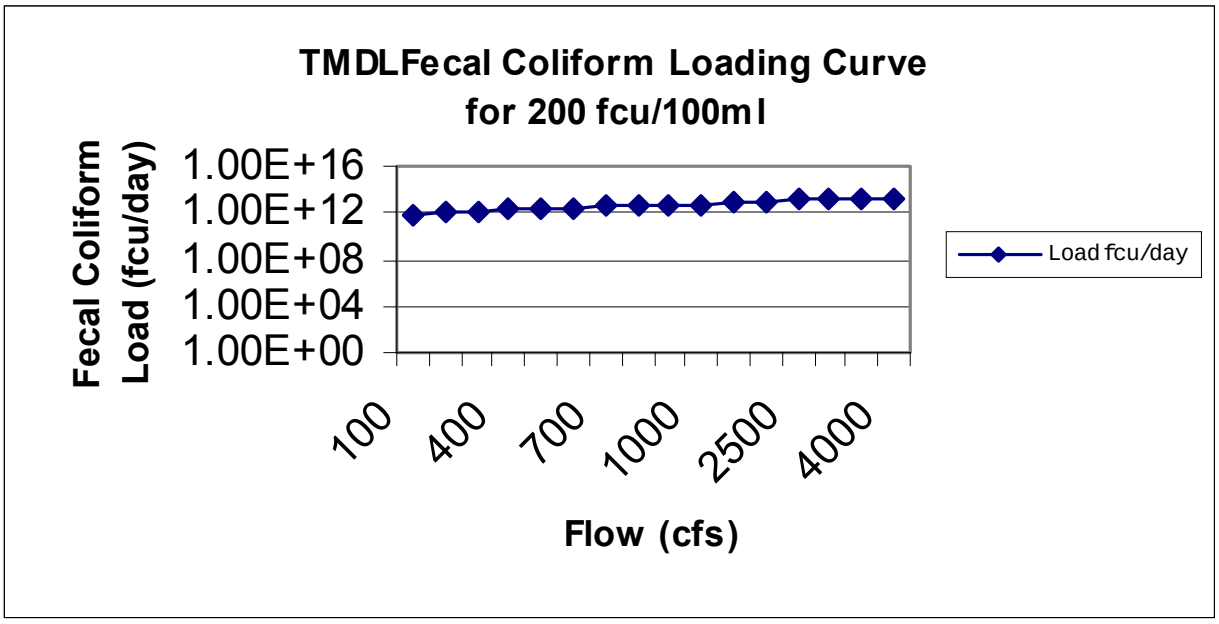
Where: C = colony forming units (cfu)/100mL
Q = stream flow in gallons/day

A traditional expression of the FC loading may be developed by setting one critical or representative flow and concentration, and calculating the fecal coliform load using Equation 1. The difficulty with this approach is in the determination of the appropriate flow or concentration value to use. For the purpose of calculating current loading on the this waterbody the average fecal coliform concentration for the May-October season was calculated using monthly LDEQ monitoring data from sampling site #0675. In Tete Bayou, the monthly fecal coliform counts for this season ranged from 130 cfu/100mL to 16,000 cfu/100mL over a seven-month period (1998). The average fecal coliform count for the May – October season is 2533 cfu/100ml (see Appendix A). In addition, the estimated average flow for Tete Bayou for the May – October season is 28 ft^3/sec (see Appendix B). Using these values and Equation 1 it is estimated that the current loading for the May – October season is 1.74 E12 cfu/day.

3.2 TMDL

Point sources usually have a defined critical receiving stream low flow such as the 7Q10 at which the criterion must be met. For nonpoint sources it is recognized that there may be no single critical flow condition. To address this condition, a fecal coliform loading curve for the recreational period (May 1 – October 31) has been generated as Figure 1. This TMDL loading curve was developed using Equation 1, substituting the criteria, 200 cfu/100 ml, for FC concentrations and varying flows. The attempt here is to show that while a TMDL may be expressed as a single point it can also be thought of as a continuum of points representing the criterion value and various flow values. This curve is not stream dependent but is dependent upon the designated stream criterion. Therefore, it may be applied to any stream with a like FC criterion. This curve represents the TMDL loading allocation for FC.

Figure 1. TMDL Fecal Coliform Loading Curve for the May – October season.



Utilizing Figure 1 one can select a stream flow and can quickly determine the FC loading value. The line formed by this series of points may be thought of as a boundary. At any given flow the loading may be below the line, within the boundary, or above the line. FC load values falling above the line represent disproportionately high values relative to the standard. FC load values falling below the line represent low loads relative to the standard. To develop load reductions one simply needs to determine the appropriate flow value (x-axis) and see where it intersects the load allocation line.

The load reduction needed to meet the water quality standard for primary contact recreation in Tete Bayou at 28 cfs is 1.60 E12 cfu/day (92% reduction). This was obtained by calculating the allowable TMDL at 28 cfs for the 200 cfu/100ml criterion (1.37 E11 cfu/day) and subtracting this load from the observed load (1.74 E12 cfu/day, see Appendix A).

Current Load - TMDL = Load Reduction

1.74 E12 cfu/day – 1.37 E11 cfu/day = 1.60 E12 cfu/day

3.3 Wasteload Allocation (WLA)

The Louisiana Water Quality Regulations require permitted point source discharges of treated sanitary wastewater to maintain a fecal coliform count of 200 cfu/100 mL in their effluent, i.e., they must meet the standard at end-of-pipe. Therefore, there will be no change in the permit requirements based upon a wasteload allocation resulting from this TMDL.

Equation 1 can be used to calculate the total point source load (wasteload allocation) utilizing a fecal coliform count of 200 cfu/100 mL and the total volume of all the wastewater dischargers (2,500,000 gallons/day).

200 cfu/100mL * 1000mL/L * 1 L/0.264 gallons * Q gallons/day = WLA

Where Q = Total volume of sanitary wastewater discharges into Tete Bayou

WLA for all dischargers = 1.89 E10 cfu/day

The WLA for the individual discharger is found in Table 2.

3.4 Load Allocation (LA)

The load allocation for each season for a given flow can be calculated using Equation 1 and the following relationship:

(TMDL@ given flow and criterion) - (WLA) = LA

LA for May – October season at an instream flow of 28 cfs = 1.18 E11 cfu/day

1.37 E11 cfu/day (TMDL@ 28 cfs) – 1.89 E10 cfu/day (WLA) = 1.18 E11 cfu/day

3.5 Seasonal Variability

Louisiana has established a seasonal water quality standard for bacteria based upon definition of a summer swimming season and winter secondary contact only. In development of this TMDL data for all seasons were evaluated and it was determined that a TMDL for the May - October season was needed to protect the primary contact recreation use.

3.6 Margin of Safety (MOS)

The Clean Water Act requires that TMDLs take into consideration a margin of safety. EPA guidance allows for the use of implicit or explicit expressions of the margin of safety or both. When conservative assumptions are used in the development of the TMDL or conservative factors are used in the calculations, the margin of safety is implicit. When a percentage of the load is factored into the TMDL calculation as a margin of safety, the margin of safety is explicit. In this TMDL for fecal coliform, conservative assumptions have been used and therefore, the margin of safety is implicit. These conservative assumptions are:

- Using average flows to calculate current loading to obtain load reduction.
- Using the more conservative 200 cfu/100mL standard rather than 400 cfu/100mL for the summer primary contact recreational season and 1,000 cfu/100mL rather than 2,000 cfu/100mL for the winter season.
- Using the design flow of the point source dischargers rather than actual average flow rates, which are typically much lower

4. Other Relevant Information

Utilizing funds under Section 106 of the federal Clean Water Act and under the authority of the Louisiana Environmental Quality Act, the LDEQ has established a program for monitoring the quality of the state's surface waters. The LDEQ Surveillance Section collects surface water samples at various locations, utilizing appropriate sampling methods and procedures for ensuring the quality of the data collected. The objectives of the surface-water monitoring program are to determine the quality of the state's surface waters, to develop a long-term database for water quality trend analysis, and to monitor the effectiveness of pollution controls. The data obtained through the surface-water monitoring program is used to develop the state's biennial 305(b) report (*Water Quality Inventory*) and the 303(d) list of impaired waters. This information is also utilized in establishing priorities for the LDEQ nonpoint source program.

The LDEQ has implemented a watershed approach to surface water quality monitoring. Through this approach, the entire state is sampled over a five-year cycle with two targeted basins sampled each year. Long-term trend monitoring sites at various locations on the larger rivers and Lake Pontchartrain are sampled throughout the five-year cycle. Sampling is conducted on a monthly basis or more frequently if necessary to yield at least 12 samples per site each year. Sampling sites are located where they are considered to be representative of the waterbody. Under the current monitoring schedule, targeted basins follow the TMDL priorities. In this manner, the first TMDLs will have been implemented by the time the first priority basins will be monitored again in the second five-year cycle. This will allow the LDEQ to determine whether there has been any improvement in water quality following implementation of the TMDLs. As the monitoring results are evaluated at the end of each year, waterbodies may be added to or removed from the 303(d) list. The sampling schedule for the first five-year cycle is shown below. The Vermilion-Teche River Basin will be sampled again in 2003.

1998 – Mermentau and Vermilion-Teche River Basins
1999 - Calcasieu and Ouachita River Basins
2000 – Barataria and Terrebonne Basins
2001 – Lake Pontchartrain Basin and Pearl River Basin
2002 – Red and Sabine River Basins

(Atchafalaya and Mississippi Rivers will be sampled continuously.)

In addition to ambient water quality sampling in the priority basins, the LDEQ has increased compliance monitoring in those basins, following the same schedule. Approximately 1,000 to 1,100 permitted facilities in the priority basins were targeted for inspections. The goal set by LDEQ was to inspect all of those facilities on the list and to sample 1/3 of the minors and 1/3 of the majors. During 1998, 476 compliance evaluation inspections and 165 compliance-sampling inspections were conducted throughout the Mermentau and Vermilion-Teche River Basins.

5. Public Participation

When EPA establishes a TMDL, 40 C.F.R. § 130.7(d)(2) requires EPA to publicly notice and seek comment concerning the TMDL. Pursuant to an October 1, 1999, Court Order, EPA prepared this TMDL. After submission of this TMDL to the Court, EPA commenced preparation of a notice seeking comments, information and data from the general and affected public. Comments and additional information were submitted during the public comment period and this Court Ordered TMDL was revised accordingly. EPA has transmitted this revised TMDL to the Court, and to the Louisiana Department of Environmental Quality (LDEQ) for incorporation into LDEQ's current water quality management plan.

REFERENCES

LDEQ, 1993. *State of Louisiana Water Quality Management Plan, Volume 6, Part A: Nonpoint Source Pollution Assessment Report.* Louisiana Department of Environmental Quality, Office of Water Resources, Baton Rouge, LA.

____, 1998. *State of Louisiana Water Quality Management Plan, Volume 5, Part B: Water Quality Inventory.* Louisiana Department of Environmental Quality, Office of Water Resources, Baton Rouge, LA.

LDEQ Statewide Ambient Water Quality Network Database (http://www.deq.state.la.us/surveillance/wqdata/0675col.txt)

APPENDIX A. Fecal Coliform data and loading calculations for each season.

Tete Bayou east of New Iberia, Louisiana

(Source: http://www.deq.state.la.us/surveillance/wqdata/0675col.txt)

This data last updated on: 08/06/00

DATE	TIME	FECAL COLIFORM MPN/100ML
12/08/98	1245	170
11/23/98	1100	1300
11/09/98	1250	1700
10/27/98	1137	130
10/13/98	1210	800
09/22/98	1130	16000
09/08/98	1120	500
08/25/98	1105	600
08/11/98	1143	230
07/28/98	1135	1300
07/14/98	1045	3000
06/23/98	1000	240

Primary Contact Recreation Standard was exceeded 67% (6 of 9 samples) from May 1 to October 31 and 67% (8 of 12 samples) annually.

	Flow (cfs)	Flow (gal/day)	Fecal Coliform (cfu/100mL)	Load (cfu/day)
Current Load	28	18,096,870	2533	1.74 E12
Allowable Load	28	18,096,870	200	1.37 E11
Load Reduction				1.60 E12 or 92%

APPENDIX B. Flow calculation methodology

seg	area	rate	flow(cfs)	seg	area	rate	flow(cfs)	seg	area	rate	flow(cfs)	Flow at Seg end cfs	MGD
060101	84.54	1.604	135.602									136	88
060102	155.48	1.604	249.39									385	249
				060203	36.82	1.604	59.0593					59	38
060201	81.76	1.604	131.143									575	372
060202	70.01	1.604	112.296									687	444
060208	269.23	1.604	431.845									1119	723
				060212	207.30	1.071	222.018					222	143
				060207	222.50	1.071	238.298					460	298
				060204	188.10	1.071	201.455					662	428
060210	96.25	1.606	154.578									1936	1251
trans out			-1131										
060205	50.34	1.606	80.846									886	572
Trans out			-413.3										
060301	12.62	1.606	20.2677									492	318
060401	27.76	1.606	44.5826									537	347
				060211	93.66	1.606	150.418					150	97
				trans in			206.63						
				060703	151.50	1.606	243.309					600	388
								060701	**26.59**	**1.071**	**28.4779**	**28**	**18**
				060702	98.10	1.606	157.549					786	508
060601	2.83	1.606	4.54498									1328	858
				060501	62.27	1.606	100.006					100	65
								060907	39.25	1.606	63.0355	63	41
060906	148.17	1.769	262.113									1753	1133
xxxxxxx													
050102	14.37	2.11	30.3207									30	20
				050302	38.67	1.59	61.4853					61	40
				050301	369.60	1.59	587.664					649	420
				050103	141.30	2.11	298.143					298	193
				050201	372.90	2.11	786.819					787	509
				050101	250.40	2.11	528.344					528	341
				050501	305.20	2.11	643.972					644	416
050401	67.11	1.59	106.705									3043	1967
050402	45.54	1.59	72.4086									3116	2014
050701	257.61	1.769	455.712									3572	2308
Catfish Point outflow			2392.95									2393	1547
SchoonerBayou outflow			1178.62									1179	762
				050703	344.60	1.59	547.914					1727	1116
xxxxxxxx													
060901	110.87	1.769	196.129									196	127
				060909	3.06	1.769	5.41314					5	3
				060902	2.62	1.769	4.63478					10	6
								060903	36.38	1.769	64.3562	64	42
				060911	4.46	1.769	7.88974					8	5
061101	30.12	1.769	53.2823									332	214
xxxxxxxxx													
trans in			1131.1										
060801	320.37	1.769	566.735									1698	1097
trans in			206.63									1904	1231
060802	243.27	1.769	430.345									2335	1509

060803	5.51	1.769	9.74719	2345	1515
xxxxxxxxx					
direct discharge					
050602	131.31	1.769	232.287	232	150
050702	352.16	1.769	622.971	623	403
050901	170.08	1.769	300.872	301	194
060804	3.19	1.769	5.64311	6	4
060904	156.48	1.769	276.813	277	179
060910	24.93	1.769	44.1012	44	29
061102	32.03	1.769	56.6611	57	37
061103	112.09	1.769	198.287	198	128

The flow at the outfall of each subsegment was calculated based on the area of the subsegment and a rate that predicts the flow per square mile of area. Six stations were used to establish the rates and calibrate the flows at the observed stations. ***The stations were used as appropriate to the drainage area under consideration.*** This method uses the gage flow to be a composite of the base flow of the steam, the rainfall runoff on the drainage area above that point, the distributaries, the withdrawals from the stream, the point discharges, and return flow of the withdrawals from the stream. Six stations were used to prepare the subsegment flows for basins 05 and 06. The stations were 08012000 on Bayou Nezpique; 08010000 on Bayou Des Cannes; 07382500 on Bayou Courtableau; 07383500 on Bayou Des Glaises; 07385500 on Bayou Teche, Arnaudville; 07385700 on Bayou Teche, Keystone. The subsegment relationships are graphically represented in the table presented above. An Ishikawa type diagram was used to represent the tributary system of the basin in a spreadsheet format. Each row of the spreadsheet represents one subsegment, or a subsegment transfer flow. The subsegment number for the row will be listed in one of three columns. The far left column has the subsegments that represent the main stem of the stream, flowing from the top of the page down. Tributary subsegments are listed in the second or third column with the label "seg". The point that the tributary flows into the main stem is represented by a horizontal line under the segment number extending to the left and intersecting with the column one vertical line (which represents the main stem). Multiple subsegments on a tributary will be depicted with a vertical in the "seg" column, with horizontal lines tying into it. The lowest tributary subsegment that flows into the main stem will have a horizontal line under the segment number extending to the left and intersecting with the column one vertical line. A tributary to a tributary will be shown in the third column labeled "seg". For readability, the subsegment number has been repeated in the last column on the right. To obtain the average flow at the outflow of a segment, find the subsegment number in the far right column. The column to the left will be the flow in MGD, the column to the left of that will be the flow in CFS.